ENVIRONMENT SOUTHLAND

A guide to constructed wetlands

Constructed wetland in a critical source area

Wetlands play an important role in improving water quality by capturing sediment and assimilating nutrients before the water flows into rivers, lakes and estuaries. They also help with water quantity by storing water to reduce flooding and maintain summer flows and soil moisture.

Land development has removed 90% of wetlands from across Southland and we are now seeing the negative impacts of this on our freshwater resources and biodiversity, but the good news is we can construct wetlands to help address these problems.

A constructed wetland can be fitted into the farm system or land development and designed to capture sediment, kill bacteria, remove nutrients, improve biodiversity or all of the above. You can also improve other values like recreation and aesthetics, which will make a nice feature in the landscape and add value to the property.

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Te Taiao Tonga

Constructed wetland treating field tile water before discharge into waterway

Key design features of a constructed wetland

Shape

Shape is often dictated by location but an oblong shape is desirable with a width x length ratio from 1:5 to 1:10 to slow water speed down and allow sediment to settle, sunlight to kill bacteria and nutrients to be assimilated.

Depth

Depth needs to vary to treat different contaminants. For sediment capture, one to two metres will slow and retain water as long as possible to allow materials to settle and be stored until removed. For nitrogen removal, up to 70% of the wetland should be less than 0.5m deep to allow vegetation to grow and strip nutrients.

Size

Size can vary to suit location and function. For sediment and phosphorus capture, a number of smaller wetlands are often better than one large one as they can be located close to the sediment source and are easier to clean. For nitrogen and bacteria reduction, bigger is better to store lots of water for longer. NIWA recommends a size of 1% – 5% of the wetland's catchment (100 – 500m^2 per ha) to achieve nitrogen reductions from 30% – 80%.

Bunds or dams need to be set into the ground and sides to prevent water leaking underneath. They also need an overflow channel in the most stable end to release excess water after heavy rain events and allow for fish passage if required.

Planting the edges of the wetland will improve performance, reduce erosion, increase biodiversity and improve aesthetics. *Carex secta* along the normal water line protects against wind erosion and long grass. Rushes and reeds capture sediment, use nutrients and provide carbon to aid nitrogen removal. You can also add a variety of shrubs and trees for colour and food for birds and bees. Do not over plant the wetland making it cold and shady or difficult to clean with a digger.

Note: Waterfowl will sometimes feed in the sediment trap causing fine sediment to move around. This is not a problem as most will resettle, and their bacteria is less of a human health issue than bacteria from stock.

Refer to the Southland Water and Land Plan, 59A and 60 for rules on sediment trap construction.

Case study 1

This constructed wetland is located within rolling hill country in a key critical source area to capture surface and drain runoff containing nutrients, bacteria and sediment flowing into a waterway.

The catchment is 7.3 hectares and the fenced critical source area is 0.675 hectares or 9% of the catchment. The 0.1225 hectare wetland is 1.7% of the catchment and is created by a bund that is 40 metres long and three metres high. Most of the fenced area is covered in long grass to filter runoff, with some *Carex secta* planted around the normal water line to reduce wave erosion. No resource consent was required.

2017 drained critical source area

2018 constructed wetland

Cost and details

- 357m of two hotwire fencing @ $6m $2142
- 40m long by 3m high bund built by digger for 10 hrs @ $150/hr $1500
- 40 *Carex secta* @ $4 each planted $160
- **Total cost (+gst) $3802**

Performance expectations

- 70% reduction of sediment loss to waterway from grass filtering and deposition in pond
- 30% reduction in nitrogen and phosphorus loss to waterway
- Big reductions in bacteria, either trapped in filtering grass or killed by sunlight in pond
- Minimal tile maintenance required downstream due to sediment capture

Future additions or maintenance

- If desired, more planting for aesthetics or birdlife
- Annual pest plant control and ongoing animal control
- Digger for removal of accumulated sediment in pond as required (every 5 to 10 years)

Case study 2

This constructed wetland is located within hill country in a key critical source area to capture surface and tile drain runoff containing nutrients, bacteria and sediment before flowing into a waterway.

The catchment is 16 hectares and the fenced critical source area is 0.641 hectares or 4% of the catchment. The two wetlands are 0.2862 hectares or 1.8% of the catchment and created by bunds that are 14 metres and 16 metres long, and 3 metres high. Most of the fenced area is covered in long grass to filter runoff, with some *Carex secta* planted around the normal water line to reduce wave erosion. No resource consent was required.

2017 field tile in critical source area

2018 constructed wetland

Cost and details

547m of two hotwire fencing @ $6m	$3282
Two bunds built by digger for 12 hrs @ $150/hr	$1800
40 *Carex secta* @ $4 each planted	$160
Total cost (+gst)	**$5242**

Performance expectations

- 80% reduction of sediment loss to waterway from grass filtering and deposition in pond
- 40% reduction in nitrogen and phosphorus loss to waterway
- Big reductions in bacteria, either trapped in filtering grass or killed by sunlight in ponds
- Minimal tile maintenance required downstream due to sediment capture

Future additions or maintenance

- If desired, more planting for aesthetics or birdlife
- Annual pest plant control and ongoing animal control
- Digger removal of accumulated sediment in pond as required (every 5 to 10 years)

More information

More information on constructed wetlands can be found here:

- NIWA - www.niwa.co.nz
- DairyNZ – www.dairynz.co.nz
- Beef + Lamb – www.beeflambnz.com

Further assistance

For advice and designs to suit your specific needs, call 0800 76 88 45 to arrange a free visit by Environment Southland's land sustainability team.

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